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THE THELEPHORACEÆ OF NORTH AMERICA. I¹

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INTRODUCTION

This monographic study of the North American *Thelephoraceæ* was begun in 1894 as the author's contribution towards a greatly needed manual of the *Basidiomycetes* of the United States,—a need that still confronts us. It has been necessary to carry on these investigations in connection with college and other work which required most of my time, but the long period covered has been an advantage; for during these two decades there has been such widespread interest in the *Thelephoraceæ* on the part of American students of fungi that it has been possible to study this family and its distribution from extensive series of freshly collected specimens from all the important regions of North America with the exception of Alaska, Mexico, and the Colorado-New Mexico region of the United States, from which but small collections have been received. These specimens have been preserved unpoisoned in my herbarium in insect-proof tin boxes which receive herbarium sheets, and each will be cited by the number or other designation adopted by my correspondents in order that their specimens may be as useful for future reference as my own. The quantity of material always awaiting examination has confined my work to a systematic treatment of this family.

Except in the case of types of species, specimens of published exsiccati, and the specimens of Schweinitz's herbarium, I cite but few specimens from the large herbaria. This is done on account of the difficulty and large amount of time involved in making a study of the material contained in them. Serious changes in the condition of the specimens in these herbaria have been occasioned partly by time but more largely by the poisonous solutions with which the specimens were soaked for preservation under old-fashioned methods of herbarium procedure,—

¹ Issued July 1, 1914.

methods well enough adapted for flowering plants but not for fungi.

Early in the work it became apparent that the diagnoses of known species of resupinate *Thelephoraceæ* had failed utterly to enable the leading working mycologists of any country to recognize with certainty in the species about them those described in other countries, or those described for their own country by earlier students. The truth of this statement is shown by the errors and confusion in names of the common species which have been distributed in exsiccati, by the fact that in the large herbaria several different species are likely to bear the same specific name on the same or successive sheets, and by the vastly more important fact that the masters of mycology of each age, when relying wholly on the diagnoses published by their contemporaries or predecessors, have described as new species common and conspicuous resupinate fungi which had been accurately described by immediate contemporaries or predecessors, and in very many cases just as accurately by still earlier students. All the mycologists concerned in these redescriptions have been earnest strivers after truth, I am convinced, and would have preferred to employ the earlier names for their plants, could they have known that those earlier names referred with certainty to their specimens. All these people were relying, as was the usage of their time, on a few words of published description in some other than their mother tongue.

It is time to recognize generally that the resupinate *Hymenomyces*, and especially the *Thelephoraceæ*, are extremely difficult taxonomic problems. Descriptions must include more than a rather vague and generalized characterization of the mere superficial appearance and habit of the specimen with possibly a reference to spores which some one recorded for what was perhaps this species. The fungus itself is an individual of the species; the description in words and by illustration has merit in proportion to the success it has in producing in the mind of any educated stranger exactly the ideas which he could derive from the study in detail of the specimen itself. From the specimen, exact ideas may be had of coloration, of form, of dimensions, of texture, of consistency, of internal structure, of organs of minute size, of place of growth, and of host and

substratum. If the description fails to give the color as exactly as if it had been noted by comparison with such a standard work as Ridgway's 'Color Standards' or Saccardo's 'Chromotaxia,' then it is inferior to the specimen; if the description contains no information as to whether the basidia are simple or cruciate, making up the whole hymenium or arranged side by side with other organs of characteristic form, standing directly on the substratum or separated from it by densely or loosely interwoven hyphæ or other form of subhymenial layer;—if it does not contain all this information in exact terms and as much in addition as the specimen itself could afford, then it is an imperfect description of the species. It may be so imperfect that a dozen different species of fungi could be assembled, to any one of which it would apply as well as to any other, as is the case with the supposedly common and cosmopolitan *Corticium lacteum* and *C. calceum*. Published exsiccati probably contain the full dozen under each of these names.

In the case of resupinate *Hymenomycetes*, types and authentic specimens of the species are of the highest importance to supplement the prevailingly imperfect descriptions with full and exact data. Hence, the types of fungi on which the descriptions are based and the authentic specimens from the authors of the species are of importance in proportion to the degree in which these plants may yield data not afforded by the descriptions and existing illustrations of the species. In the case of the resupinate *Hymenomycetes*, the early descriptions are of slight practical value except as they are backed up by types and specimens from their authors. For this reason, if there had been no other, the International Botanical Congress, at Brussels, acted for the best interests of mycology in fixing the beginning of the naming of *Hymenomycetes* with the publication of Fries' 'Systema Mycologicum,'—the time when the preservation of types and authentic specimens of such fungi in herbaria became so prevalent that it was possible for later mycologists to distinguish the resupinate species by taking the trouble to study the types, if authentic specimens could not be obtained.

My method of becoming acquainted with our described species of *Thelephoraceæ* has been to study and arrange by species in my herbarium the specimens as they have accumu-

lated. In this arrangement due regard has been given to original descriptions of species and to all details of internal structure. Spore collections on glass slides have been made for each species whenever possible, and about five thousand mounts of sectional preparations in glycerin have been made from collections and preserved for reference in connection with internal structure of the specimens. From time to time I have taken my *Thelephoraceæ* to herbaria where the types of our American species are stored and have there painstakingly matched them with the types. I have made sectional preparations from a fragment of each of these types in order to make sure that my specimens match the types not only in external characters but also in all details of internal structure. The sectional preparations of type specimens have been preserved in glycerin. Specimens from my herbarium which have been so matched with type specimens have been used by me later for the determinations of subsequent collections. Such methods of investigation are probably too laborious and require too much time to become popular and they afford little opportunity for the inspirational flights attributed to genius, but they do afford a means of determining within very narrow limits the species of North American *Thelephoraceæ*.

I am under especial obligation to Dr. W. G. Farlow for suggesting this work, for interest in its progress, and for frequent access to the Curtis Herbarium for comparisons with types. I am indebted also to Dr. C. H. Peck for opportunity to study his types in the New York State Herbarium, to the late Dr. L. M. Underwood for similar opportunity with the Ellis types in the Herbarium of the New York Botanical Garden, to Dr. S. W. Dixon and Professor S. Brown, of the Philadelphia Academy of Natural Sciences, for the privilege of studying in the Schweinitz Herbarium, to Sir W. T. Thistleton-Dyer and Mr. G. Masee for access to types and authentic specimens in Kew Herbarium, to the late Dr. T. M. Fries for the privilege of studying in the Herbarium of Elias Fries, at Upsala, and to Mr. Lars Romell, of Stockholm, Dr. P. A. Karsten, of Mustiala, and Abate G. Bresadola, of Trient, for many authentic specimens of their own species and for specimens which they had compared with types of early authors of *Thelephoraceæ* of

Europe. In the later pages names of the many botanists who have participated in this work by the contribution of specimens from their respective regions are given in connection with the specimens. I feel my obligation to each of these correspondents.

Having become thoroughly familiar with the species of a family of fungi, one then faces the task of deciding under what genera they shall be grouped in order that others may more easily recognize them. Our studies in systematic botany and the accumulations of plants in herbaria are primarily for the purpose of enabling those who wish to obtain information about any particular plant, however obscure, to determine its name accurately and so be in a position to get at the world's literature and knowledge concerning that species; and also to enable botanists so to entitle and index their researches that the results will be more available to the world at large. Stability in the nomenclature of plants is therefore important, and revolutionary changes in generic conceptions should not be lightly and frequently made. Whenever one proposes new genera to supersede a well-established genus which has satisfactorily embraced the related species of the world, the burden of proof should be on the one who makes the change to demonstrate that the advantages from the innovation will more than compensate for the confusion which would result as well as for the loss of knowledge indexed under the superseded name.

Many new genera of fungi have been proposed during recent years. These have frequently come from students with a limited knowledge of the species of the world. It is not surprising that a botanist working on the few species of a limited region should be led to the establishment of new genera on the basis of what seem to be sharp differences in his species or groups of species. When, however, his knowledge encompasses just as definitely the structure of the many species of some large portion of the world, his perspective changes, and he may now find that the species which he formerly regarded as generically distinct are so closely connected by intermediate species that the contemplated generic separation would be unnatural and a hindrance to botanical progress. It is fundamental that genera be so sharply defined that any accurate observer who will make

the study necessary for the application of the generic definition may be sure ninety-nine times out of a hundred that the fungus on which he is working is a *Stereum*, for example, and not a *Thelephora*, nor a *Craterellus*, nor a *Cladoderris*, nor a *Corticium*, nor a *Peniophora*, nor a *Sebacina*. It is an obligation on authors to group their species so accurately under genera that *Stereum*, for example, shall comprise all the species of this genus known to science, and no others. The synonymy of species in later pages will show how vaguely the genera of *Thelephoraceæ* have been comprehended.

It is desirable that a genus should consist of but few species in those cases where the group is sharply and naturally set off from others, that is, where no intermediate species connect the genus with other groups. While such small genera are desirable, if wholly natural, it is in the highest degree objectionable to create small artificial genera by arbitrarily segregating the species of a natural genus and so establishing indefinite lines of demarkation between genera. Under such a procedure the generic location of certain species becomes wholly arbitrary and always continues as a stumbling block for new students and this leads to the loading of our literature with so-called new species. A case in point is Saccardo's scheme in the 'Sylloge Fungorum' in which he separates *Hypochnus* from *Corticium* and *Peniophora* without any natural generic planes of cleavage. In practical work one needs to know exactly what the generic limits of *Corticium*, *Peniophora*, and *Hypochnus* are. The question naturally arises as to just how loose and open the structure of the fructification must be to be included in the genus *Hypochnus* rather than in *Corticium* or *Peniophora*. Henning's violation of the principle involved is still more flagrant, for he separated the *Hypochnaceæ* as a new family from the *Thelephoraceæ*¹ and placed *Hypochnus* of Saccardo in the *Hypochnaceæ*, and *Corticium* and *Peniophora* in the *Thelephoraceæ*. As all students of the *Thelephoraceæ* have found *Hypochnus*, as understood by Saccardo, wholly unworkable, it would increase the usefulness of the 'Sylloge Fungorum' if Saccardo were to distribute among *Corticium* and *Peniophora*, the species which he now includes under *Hypochnus*.

¹Engler und Prantl, Nat. Pflanzenfam. (I. 1**): 114. 1898.

Probably all species of *Corticium*, as originally understood, have an hymenium composed of basidia arranged side by side between non-sporebearing organs termed paraphyses. In many species, it is difficult to distinguish between the basidia and the paraphyses except by prolonged study of special preparations or by observations made at the time the basidia bear spores. In other species the sterile organs are conspicuous and distinct from the basidia either by their larger size, different form, or thicker or incrustated walls. Such conspicuous bodies are called cystidia, but if the paraphyses are merely finely but characteristically branched near their tips, they are not called cystidia. Such branched paraphyses occur in the hymenium of occasional species of several genera of the *Thelephoraceæ* and are valuable characters for specific diagnosis.

In 1880, Cooke proposed, from Kew Herbarium, to divide the old genus *Corticium* into two genera,—the name *Corticium* to be retained for those species having the non-sporebearing organs of the hymenium not distinguishable from the basidia, and the generic name *Peniophora* to be given to those species having cystidia. As the species of *Corticium* were very numerous and extremely difficult taxonomically, this proposal was hopefully received, and for more than thirty years the transfer of species from *Corticium* to *Peniophora* has been going on and the end has not been reached yet. During this long period there has been confusion as to which species of the old genus *Corticium* belong in the emended *Corticium* and which in the genus *Peniophora*.

Peniophora is an artificial rather than a natural genus, however, and its adoption has given to many species a position intermediate between this genus and *Corticium*. These intermediate species have to be classed with the one genus or the other according to personal judgment, for no one can state just how conspicuous the sterile organs must be, nor of how constant occurrence, to merit the name cystidia. In *Corticium Sambuci* Fr., for example, cystidia are readily found in preparations from some collections, but several preparations may have to be made to demonstrate them in other collections. In the same species and in different parts of the same section, cystidia may sometimes be sparingly and sometimes not at all incrustated. Some

species which I have placed in the genus *Peniophora* because of the presence of cystidia students may look for under *Corticium* when, by a more hasty study of their collections, they fail to detect these organs. On the other hand, students using more discriminating methods than mine may detect cystidia in species in which I have overlooked them, and such students will search in *Peniophora* for species which I have placed under *Corticium*. Species intermediate between genera always cause such trouble. There are many intermediates between *Peniophora* and *Corticium*, yet in this particular case the advantage from the separation undoubtedly more than compensates for the disadvantages occasioned by the intermediate species.

The case of *Peniophora* has been considered at length, because this genus is being regarded as a precedent for subdividing *Stereum* and grouping under *Lloydella* all those species which have conspicuous non-sporebearing organs between the basidia. Such a separation, however, would be artificial and give rise to a troublesome series of intermediate species, without the compensating advantage which accrued in the case of *Peniophora* and *Corticium*. *Stereum* is not a genus of difficult species nor does it comprise an immense number of species. It is just a fine, natural group of species capable of being more sharply defined than it was by Fries, so as to receive some species from *Thelephora* of Fries and to part with some to *Corticium*. So defined, even beginners will have no trouble in recognizing species of *Stereum*. Systematic work in mycology should strive to establish and maintain just such natural, clean-cut genera as *Stereum*.

It seems to me best to work along constructive rather than destructive lines. Fries had a wonderful ability for the perception of the natural grouping of fungi on the basis of gross morphology and habit. Since his time, research has greatly enlarged the knowledge of the internal structure of fungi and of the organs of propagation. The value of such organs in the classification of seed plants is well known. It is feasible to modify somewhat the genera of *Thelephoraceæ* as defined by Fries, in accordance with the true relationships and differences shown by the present knowledge of internal structure, basidia, and spores, and a system results which is the natural evolution of taxonomic and morphologic study of *Thelephoraceæ*. This

system has been communicated to my correspondents in connection with specimens. Its principal features are:

1. To restrict *Thelephora* to pileate species with simple basidia and colored spores.
2. To follow Karsten and Bresadola in placing under *Hypochnus* only resupinate species with colored echinulate spores.
3. To restrict *Stereum* to pileate species which have simple basidia and colorless spores and lack setæ in the hymenium.
4. To include in *Hymenochaete* all species having setæ.
5. To include in *Corticium* species always resupinate, which have colorless spores and lack cystidia, excepting those species which for other reasons are placed in *Exobasidium*. Include in *Corticium* hypochnoid as well as compact species.
6. To include in *Peniophora* all species which differ from *Corticium* merely by the presence of cystidia.

I find this system workable and very satisfactory for the accurate location of species in genera, except in the case of the species intermediate between *Peniophora* and *Corticium*. The proposals to subdivide *Peniophora* into *Glæocystidium*, *Peniophorella*, *Glæopeniophora*, etc., would create large numbers of species intermediate between the new genera, without compensating advantages.

I have studied the species of my predecessors and co-workers sympathetically and have endeavored to find real differences between their species and those previously known so that the validity of theirs might be confirmed. The great area of land covered by the present work, the differences in climate and substratum, and the keen search by my correspondents have brought to hand a very large number of specimens. I have earnestly striven to place them under species already known, but it has been necessary to describe many as new. I regret that there are so many of these. Should any one have reason to believe that in any case I have described as new a species already known, I shall esteem it a favor to receive an authentic specimen of the older species or to be informed where such a specimen can be consulted.

Colors of specimens were noted and recorded during the first years of my work by comparison with Saccardo's 'Chromotaxia' in accordance with his descriptive terms. Recently I have been using Ridgway's 'Color Standards and Nomenclature,' 1912, which has a greater variety of colors useful in the characterization of the species of *Thelephoraceæ*.

In my own work with collections of living fungi I am endeavoring to gather for each species a spore collection on a glass slip. The spores adhere well so that they may be covered by paper and preserved in the envelope with the dried specimens from which the spores were obtained. Such collections give the exact color and dimensions of mature spores. These dimensions are generally rather larger than those obtained from spores of sectional preparations of dried herbarium specimens. The spores of dried specimens, i. e., those remaining attached to the specimens, are probably too immature to be of normal size, and sometimes there are so few of them that one must exercise caution to avoid errors due to the study of spores foreign to the fungus.

Latex exists in many species of several of the genera and is more abundant and conspicuous in some species than in others, and its containing elements often extend to the hymenial surface. When specimens are in the vegetative condition, injury to the hymenium may liberate the fluid contents of the latex bodies so that this fluid exudes in colored drops at the edges of the wound, or discolors the bruised surface. For many of our species there is a lack of data concerning the color of this fluid or the discoloration. The latex bodies are pale brown in microscopic preparations made by my methods and must not be confused with setæ or cystidia. Latex is well shown in *Stereum spadiceum*, *S. sanguinolentum*, and *Corticium lactescens*.

There has been a disposition on the part of some authors to regard the *Thelephoraceæ* as not sharply separated from the *Hyphomycetes*. The specimens which I have collected, in striving to find all the *Thelephoraceæ* of my collecting region, and the specimens received from my correspondents afford no embarrassment in recognizing the most hypochnoid species of *Thelephoraceæ* by the basidia which characterize the families of *Hymenomycetes* in general.

The microscopical technique has been simplified as much as possible. Usually dried herbarium material had to be used for study and proved very satisfactory except in the case of specimens which had been subjected to poisoning processes for preservation in herbaria. A small bit of the fructification having a promising hymenial surface 2 or 3mm. square—but smaller if the specimen is a valuable type—is first moistened with alcohol, then wet with water and cut out from the rest of the specimen and from the substratum. This bit is then placed in a holder of elder pith and oriented so that the sections may be cut perpendicular to the surface of the hymenium and also contain as long hyphæ as possible. The sections are cut as thin as possible, free hand, with a very keen section razor flooded with alcohol. The thinnest sections are placed on a slide in a drop of water and then a drop of seven per cent aqueous solution of potassium hydrate is added.

Close observation of the sections should be made when the potassium hydrate solution comes in contact with them. For most species, the sections are merely cleared and the hyphæ swelled to the normal size of vegetative hyphæ. In a few species, the alkaline solution may dissolve out the color of the section on coming in contact with it, or it may change this color to a violet, which finally disappears, or it may cause disorganization changes in certain structures leading to their disappearance or destruction. Such changes should be observed and noted, for they are of help in the determination of the species. In the cases in which potassium hydrate solution exerts a destructive action, lactic acid should be employed with other sections in the manner described for potassium hydrate. Lactic acid clears and swells sections well, but so much more slowly than potassium hydrate that I have used it only where the latter is not satisfactory. After the sections have been cleared, the potassium hydrate should be drained off, the sections lightly stained on the slide with alcoholic solution of eosin (but not overstained), mounted in water, and studied at once.

For a thorough study of the species of the family at least one permanent preparation of each species should be retained for future comparisons. Permanent preparations may be made from the temporary water mounts by adding dilute glycerin—

two-thirds glycerin and one-third water—at the edge of the cover glass and allowing the glycerin to run under the latter as the water evaporates. When concentration of the glycerin is adequate, the excess should be wiped away with moist filter paper and the resulting smear removed to the very edge of the cover glass with a soft cloth moistened with 95 per cent alcohol. The preparations may then be sealed from the atmosphere by painting a ring of microscopical cement about the edge of the cover glass. At least two coats should be used for this ring, a light and very narrow one, and, after this dries, a very heavy, broad one. I have used Bell's Microscopical Cement, made in London, and Brunswick Black Cement. A variable percentage of the rings crack in the course of a few years and allow the glycerin to escape from under the cover glass, but the sections in such preparations can be remounted. Dr. Thaxter has very recently informed me that he has been using King's Transparent White Cement and King's Amber Cement for fifteen years and that none of the rings made with these cements have cracked. By the use of circular cover glasses rather than square ones, a microscopist's turn table may be used, thereby materially lessening the labor of preparing the rings.

SYSTEMATIC ACCOUNT

THELEPHORACEÆ

Thelephoreæ Persoon, Myc. Eur. 1: 109. 1822; Fries, Hym. Eur. 629. 1872; Saccardo, Syll. Fung. 6:513. 1888.

Hymenomyces with the hymenium inferior or amphigenous (on the lower surface or surrounding the fructification), coriaceous or waxy, even, rarely ribbed or papillate.

Through several of the genera the *Thelephoraceæ* connect closely with all the other families of the *Hymenomyces*. *Hypochnus* approaches *Grandinia* of the *Hydnaceæ* in the granular hymenial surface of many of the species, but can be separated from this hydnaceous genus by the spore characters. *Lachnocladium*, with coriaceous structure, hairy stem, and colorless spores, is an intermediate genus between *Clavaria*, of the *Clavariaceæ*, and *Thelephora* but can be separated from the latter by the spore characters. *Craterellus* connects with

Cantharellus, of the *Agaricaceæ*. Some species of *Corticium* must be cautiously separated from *Merulius*, of the *Polyporaceæ*. The species of *Tremellodendron*, *Hirneolina*, and *Sebacina* were formerly distributed among *Thelephora*, *Stereum*, and *Corticium* respectively, but are now separated from these genera by the cruciate character of the basidia,—such basidia as are present in many *Tremellaceæ*. All these connecting genera will be included in the present monograph.

Michenera and *Heterobasidium* are excluded genera. Lyman has shown¹ that *Michenera artocreas* B. & C. is only a stage in the life history of *Corticium subgiganteum* B. & C., and that the genus *Michenera* has ceased to be a genus of the Basidiomycetes. My own study of the type of *Heterobasidium chlorascens* Massee, which is the type species of the genus, failed to locate any basidia whatever.

Very many *Thelephoraceæ* are of great economic importance on account of the dry rot induced by the growth of the mycelium in sills, floors, mine, bridge, and dock timbers, and other wooden structures located in moist, poorly ventilated places. *Coniophora puteana* is a common species which rots coniferous wood. Only a very few *Thelephoraceæ* are classed as serious plant parasites. Of these the rhizoctonial stage of *Corticium vagum* is the most important.

KEY TO THE GENERA

I. EU-THELEPHOREÆ:

Fructification not containing green lichen gonidia.

- | | |
|---|------------------------|
| Fructification fleshy or membranaceous, often infundibuliform, with the hymenium distinct, continuous, even, ribbed or at length rugose; basidia simple | <i>Craterellus</i> |
| Fructification submembranaceous, cup-shaped, often pendulous; hymenium typically concave, discoid; basidia simple | <i>Cyphella</i> |
| Fructification consisting of only a fleshy hymenium on the surface of living leaves and shoots; basidia simple | <i>Exobasidium</i> |
| Fructification coriaceous or hard | 1 |
| 1. Basidia globose or pyriform, longitudinally cruciately 4-septate or divided when mature; fructification erect, clavariiform, more or less branched | <i>Tremellodendron</i> |

¹ Cultural studies on the polymorphism of Hymenomycetes. Proc. Boston Soc. Nat. Hist. 33: 151-60. 1907.

1. Basidia cruciate as in *Tremellodendron*; fructification effuso-reflexed or cup-shaped with the margin free *Hirneolina*
1. Basidia cruciate as in *Tremellodendron*; fructification always resupinate. *Sebacina*
1. Basidia simple but with such large sterigmata as to resemble longitudinally divided basidia¹ *Tulasnella*
1. Basidia at first globose and simple, at length elongated and transversely septate, straight or curved, bearing sterigmata on the convex side; fructification resupinate *Septobasidium*
1. Basidia simple, usually 4-spored 2
 2. Spores colored; fructification pileate *Thelephora*
 2. Spores colored, rough-walled to echinulate; fructification resupinate *Hypochnus*
 2. Spores ochraceous, ferruginous or fuscous, even; fructification resupinate. *Coniophora*
 2. Spores white or rarely bright colored, even or rarely uneven 3
3. Setæ (brown, cylindric, rigid, even-walled bodies) present in the hymenium; fructifications range from pileate to resupinate. *Hymenochaete*
3. Cylindric teeth composed of many consolidated hyphæ protrude from the hymenium but are not covered by it. Our southern species was originally described as a *Hydnum*. *Mycobonia*
3. Neither setæ nor teeth present in the hymenium 4
 4. Fructification coriaceous, erect, clavariiform; stem often hairy. . *Lachnocladium*
 4. Fructification cup-shaped, resupinate with free margin or simply resupinate; hymenium pulverulent; with some two or three of the following characters: (1) large white spores ranging from 14-34 x 12-20 μ ; (2) much granular matter in the fructification; (3) prominent moniliform or branched paraphyses; (4) racemose organs in the hymenium which produce a crop of conidia before basidiospores develop. *Aleurodiscus*
 4. Fructification pileate ranging from infundibuliform and flabelliform to very narrowly reflexed forms; hymenium even. Some reflexed species may occur resupinate. *Stereum*
 4. Fructification like that of an urn-shaped *Stereum* but hard and stuffed. One tropical species *Hypolyssus*
 4. Fructification like that of *Stereum* but with the hymenium hardened and with radiating branched ribs. Species tropical. *Cladoderis*
 4. Fructification always resupinate; structure not as in *Aleurodiscus*. 5
5. Subhymenial tissue contains conspicuous brown stellate organs composed of several radiating arms. *Asterostroma*
5. Such brown stellate organs not present 6
 6. Cystidia present in hymenium, or in subhymenial tissue, or in both; structure may be compact or hypochneid. *Peniophora*
 6. Cystidia not present; structure compact or hypochneid. *Corticium*

¹ With regard to the nature of these bodies see H. O. Juel, Bihang till K. Sv. Vet.-Akad. Handl. 23¹²: Afd. III. 3-27. 1897.

II. HYMENO-LICHENS:

Fructification regularly containing green lichen gonidia.

Species tropical.

Fructification pileate, coriaceous-membranaceous, with hymenium on the lower surface and somewhat waxy; gonidial layer composed of somewhat cubical masses of algal cells..... *Cora*

Fructification like *Cora* in most respects but with the hymenium somewhat gelatinous and the gonidial layer composed of algal cells arranged in rows (cateniform) *Rhipidonema*

THELEPHORA

Thelephora Ehrhart [Crypt. Exsic. No. 178. 1785] Fries, Syst. Myc. 1: 428. 1821 (in part).—Persoon, Myc. Eur. 1: 110. 1822 (in part).—Saccardo, Syll. Fung. 6: 521. 1888 (in part).—Hennings, in Engl. & Prantl, Nat. Pflanzenfam. (1. 1**): 125. 1898 (in part).

The type species of the genus is *Thelephora terrestris* Ehrh. ex Fries.

Fructifications pileate or clavate, coriaceous; hymenium continuous with the hymenophore and similar to it, inferior, or amphigenous in a few species, even or faintly ribbed or papillose; basidia simple, 4-spored; spores colored, typically muricate but even, or rough-walled in a few species.

As more broadly defined by Fries and the other authors cited, *Thelephora* has been heterogeneous, consisting chiefly of the natural and homogeneous group of species defined above but also of some pileate species with simple basidia and hyaline spores, transferred to *Stereum*; also of some species with globose, longitudinally septate basidia, transferred to *Tremellodendron*, if with erect fructifications, or to *Sebacina*, if resupinate; and also of some resupinate species having simple basidia, of which those with muricate and colored spores may be found in *Hypochnus*, those with colored and even spores, in *Coniophora*, and those with hyaline spores, in *Corticium* and *Peniophora*. It is probable that the species of Patouillard's section *Dendrocladium* of the genus *Lachnocladium* as understood by Patouillard¹ might be transferred to *Thelephora* with advantage both to *Thelephora* and *Lachnocladium*, but these species are not within the geographical limits of my work.

¹ Fragments Mycologiques (suite). Jour. de Bot. 3:33-37. 1889.

KEY TO THE SPECIES

- Erect species, usually with central stem and pileus divided into very narrow, branching, flattened or cylindric divisions; hymenium inferior or amphigenous 1
- Erect species, usually with central stem and more or less infundibuliform, cup-shaped or flabelliform pileus, which may be radially split into lobes and divisions 2
- Species of incrusting, effuso-reflexed, dimidiate, or applanate habit 5
1. 2-6 cm. high, much branched, glabrous, with fetid odor when growing, perhaps rarely odorless 1. *T. palmata*
 1. 3-5 cm. high, much branched, minutely pubescent; stem villose, without fetid odor. Compare *T. multipartita* 2. *T. anthocephala*
 1. Less than 2½ cm. high, branching at or below surface of ground, dusky drab except at base 3. *T. caespitulans*
 1. Less than 2 cm. high, very slender and fragile, cinereous. Known only from State of Washington 4. *T. scissilis*
 1. Large species, highly branched, with body of spore of regular obovoid form. Known only from Central America 5. *T. angustata*
 2. Hymenium dark colored, i. e., brown to fuscous 3
 2. Hymenium light colored, i. e., pallid to gray 4
 3. Small species, 1½-3 cm. high, upper surface usually drying pallid, usually deeply cleft or many-parted into narrow divisions; stem villose. 6. *T. multipartita*
 3. Small species, 6 mm.-2½ cm. high, infundibuliform or deeply divided into two or three triangular divisions, or flabelliform; stem villose. Closely related to *T. multipartita* 7. *T. regularis*
 3. Fructification 1 cm. high, white; stem white, glabrous. Known only from Guadeloupe 8. *T. pusiola*
 3. 1½-5 cm. high, larger species than the three preceding but with thinner pileus, fuscous purple (Rood's brown) throughout, often with the thin lobes imbricate like the petals of a carnation; stem villose 9. *T. caryophyllea*
 3. 2-4 cm. high, somewhat tubular, hymenium vinaceous brown to drab; stem sulcate and pitted but not villose; spores 10-14 μ in diameter. Known only from Jamaica 10. *T. magnispora*
 3. Large species, 2½-7 cm. in diameter, with upper surface pallid except at the center and with the hymenium dark 13. *T. vialis*
 4. Small species, less than 2 cm. in height and in diameter, somewhat pallid to brick-red 7. *T. regularis*
 4. Pileus with outer lobes forming a cup and with inner lobes distinct, crowded, erect, cinereo-fuscous. Known from Costa Rica and Brazil. 11. *T. corbiformis*
 4. Large species, 5-7 cm. broad, deeply infundibuliform, habit and color of *Craterellus cornucopioides*. Costa Rica and Jamaica. 12. *T. cornucopioides*
 5. Growing in applanate clusters, effuso-reflexed, or dimidiate 6
 5. Always incrusting (*T. albido-brunnea* is sometimes incrusting) 8
 6. Hymenium pale and colored like the pileus, cinnamon-buff; pileus spongy, more than 2 mm. thick; spores 8-10 x 6-8 μ 14. *T. albido-brunnea*
 6. Hymenium and pileus yellowish, less than 2 mm. thick; spores 5-6 x 4 μ 15. *T. luteola*

6. Hymenium drab, becoming sage-green when crushed in 7 per cent potassium hydrate solution; pileus pinkish buff to cinnamon-brown with a broad pale margin.....16. *T. cuticularis*
6. Hymenium ferruginous brown (Rood's brown) to fuscous 7
7. Pileus, when squamulose, with the fibers matted and agglutinated into appressed and wholly adnate squamules, margin dilated and whitish fimbriate becoming entire and concolorous.....17. *T. intybacea*
7. Pileus not zonate, fibrous-squamulose and usually strigose, margin fibrous-fimbriate18. *T. terrestris*
7. Pileus zonate, in other respects resembling the preceding species.....
19. *T. griseozonata*
8. Incrusting and ascending small plants, free branches somewhat terete but flattened towards the tips; spores umbrinous.....20. *T. fimbriata*
8. Resupinate on leaves and twigs on the ground and sending up free, simple or branching trunks; spores fuscous. Known from Cuba only 21. *T. perplexa*
8. Incrusting leaves, etc., on the ground and ascending as sessile flabelliform pilei which are dentate at the upper end or deeply divided, honey-yellow to tawny olivaceous throughout. Known from Cuba only....
22. *T. dentosa*
8. Typically effused, rising obliquely upward from the support as a cluster of small trunks which branch and terminate in spiculous tips. 23. *T. spiculosa*

1. *Thelephora palmata* Scop. ex Fries, Syst. Myc. 1: 432. 1821. Plate 4. fig. 4.

Clavaria palmata Scop. Fl. Carn. 2: 483. 1760.—*Ramaria palmata* Holmsk. Fun. Dan. 1: 106. pl.—.1799. —*Merisma foetidum* Pers. Syn. Fung. 584. 1801.—*M. palmata* Pers. Myc. Eur. 1:113. 1822.—*Thelephora palmata americana* Peck, Rep. N. Y. State Mus. 53: 857. 1900.

Illustrations: Greville, Crypt. Fl. 1: pl. 46.—Holmskiöld, Fun. Dan. 1: pl. of *Ramaria palmata*.—Krombholz, Abbild. und Beschr. pl. 54. f. 24, 25.—Nees, System pl. 16. f. 151 B.—Baillon, Dictionn. de Botan. 1: 737. f. 7.—Loudon, Encyc. of Plants f. 16131.—Winter, Crypt. Flora 1: 321.

Fructification coriaceous-soft, fuscous purple, drying cinnamon-brown or chestnut-brown, erect, very much branched, with very fetid odor; pileus with numerous somewhat fastigiate, palmate divisions which are even, flattened, dilated above, and with fimbriate and whitish tips; stem simple or soon branched; hymenium amphigenous; spores pale umbrinous under the microscope, sparingly echinulate, $10 \times 7-8 \mu$.

Fructification of American specimens 2-6 cm. high, 1-3 cm. broad; stem $1-1\frac{1}{2}$ cm. long, 1-2 mm. thick.

On moist ground in coniferous woods and also in grassy fields. Prince Edward Island to North Carolina and west to Illinois. June to October.

In the American collections of this species the divisions of the pileus are narrow and a short stem is present. The habit is so similar to that of *Thelephora anthocephala* that record of the fetid odor should always be made if observed. The ultimate branches may be more or less terete, leading to the variety *americana* Pk.

Specimens examined:

Exsiccati: Ell. & Ev., N. Am. Fungi, 1937.

Austria: *G. Bresadola*.¹

Sweden: *L. Romell*, 53.

Canada: Rustico Bay, Prince Edward Island, *J. Macoun*, 324.

New Hampshire: Chocorua, *W. G. Farlow*.

? Vermont: no locality data for specimen in Frost Herb., Univ. of Vermont.

Connecticut: Manchester, *C. C. Hanmer*, 1398.

New York: Fischer's Island, *C. C. Hanmer*, 196.

New Jersey: *C. G. Lloyd*, 4612.

Pennsylvania: Bethlehem, *Schweinitz*, Syn. N. Am. Fungi, 612 (in Herb. Schw.); Trexlertown, *Dr. W. Herbst*; Kitanning, *D. R. Sumstine*, 2; West Chester, *B. M. Everhart*, Ell. & Ev., N. Am. Fungi, 1937.

Delaware: Newark, *H. S. Jackson*.

Dist. of Columbia: Washington, *O. F. Cook*, comm. by P. L. Ricker, 1, 3.

N. Carolina: Asheville, *H. C. Beardslee*, 924.

Ohio: Connecticut, *C. G. Lloyd*, 4493.

Illinois: Glencoe, *E. T. and S. A. Harper*, 664, 665.

Missouri: St. Louis, *N. M. Glatfelter* (in Mo. Bot. Gard. Herb., 42560).

¹ With regard to the citation of specimens all except those of "Exsiccati" are in Burt Herb. which are cited without explicit reference to place in other herbaria. For example, the specimen cited, "Connecticut: Manchester, *C. C. Hanmer*, 196," is in Burt Herb. The data given is that received with the specimen and may identify a duplicate in another herbarium. The location of all specimens in herbaria other than my own is designated by the name of the herbarium in parenthesis with the prefix "in." For example, the specimen cited, "Louisiana: St. Martinville, *A. B. Langlois* (in Lloyd Herb., 3000)," is in Lloyd Herb., but not in Burt Herb.

2. *T. anthocephala* Bull. ex Fries, Syst. Myc. 1: 433. 1821.

Plate 4. fig. 1.

Clavaria anthocephala Bull. Herb. de la France 2: 197. pl. 452. f. 1. 1789.

Illustrations: Bulliard, *Ibid.* pl. 452. f. 1.—Sowerby, Col. Figs. Eng. Fun. pl. 156.—Berkeley, Outlines Brit. Fung. pl. 17. f. 4.—Dufour, Atlas des Champ. pl. 70.

Fructification coriaceous-soft, somewhat ferruginous, drying fawn-color or cinnamon-brown, inodorous; pileus pubescent, divided to the stem into flaps which are dilated upwards and fimbriate and whitish at the apex or divided into irregular, branched, erect branches; stem simple, equal, villose; hymenium even; spores pale umbrinous under the microscope, ranging from angular-tuberculate to tuberculate-echinulate, 8–10 x 7–8 μ .

Fructifications 3–5 cm. high, 1–3 cm. broad; stem 1–1½ cm. long, 1–2 mm. thick.

On the ground in woods. Massachusetts and Ohio to Louisiana. June to August. Rare.

Our specimens of *T. anthocephala* and *T. palmata* have the same habit but may be separated, even when dried, by the fine pubescence of the pileus visible with a lens, and by the villose-tomentose stem of the former. The spores of *T. anthocephala* are further slightly paler and have shorter spines with broader bases than those of *T. palmata*.

Specimens examined:

Austria: *G. Bresadola*.

Massachusetts: Newton, *W. G. Farlow* (in Farlow Herb.).

New York: Van Cortlandt Park, N. Y. City, *L. O. Overholts* (in Overholts Herb., 688).

Pennsylvania: Kitanning, *D. R. Sumstine*, 10; Bethlehem, *Schweinitz* (in Herb. Schw.), the 614 of Syn. N. A. Fungi under the name *T. flabellaris*.

North Carolina: Asheville, *H. C. Beardslee*, 0268.

Louisiana: St. Martinville, *A. B. Langlois*, unnumbered specimen, and 1971, and by the same collector (in Lloyd Herb., 3000).

Ohio: Norwood and Linwood, *C. G. Lloyd*, 1472 and 02164 respectively.

Kentucky: *C. G. Lloyd*, 1395.

Missouri: St. Louis, *N. M. Glatfelter* (in Mo. Bot. Gard. Herb., 42559).

3. *T. caespitulans* Schw. Trans. Am. Phil. Soc. N. S. 4: 166. 1831.¹

Type: in Herb. Schweinitz.

Fructification erect, coriaceous, dusky drab to olive-brown below, paler above, very much branched, forming clusters $2\frac{1}{2}$ cm. high by $2\frac{1}{2}$ cm. broad; pileus with numerous divisions joined together into a solid base but assurgent above and pressed together closely, compressed, subcanaliculate, frequently obtuse and whitish at the apex; hymenium amphigenous; spores umbrinous under the microscope, sparingly tuberculate, $7-8 \times 5-6\mu$.

On the ground in mixed woods, Vermont to South Carolina, and in dense coniferous woods, Washington. September. Rare.

This species is related to *T. palmata* but is more olivaceous, and it is probably inodorous,—at least no odor has been noted. The dimensions for the clusters given above, as stated by Schweinitz, are probably maximum dimensions, for the specimens recently collected have been rather smaller. My Vermont specimens were growing with the thick, solid base buried in sandy ground in a wood road; they have dried pallid except at the base and are slightly pubescent. The general habit of this species is somewhat suggested by a small cluster of *Tremelodendron pallidum* (Schw.) Atk.

Specimens examined:

Vermont: Lake Dunmore, *E. A. Burt*.

Pennsylvania: Bethlehem, *Schweinitz*, type (in Herb. Schw., Acad. Nat. Sci., Phila.).

South Carolina: Santee Canal, *Ravenel*, 1660 (in Curtis Herb. under name *T. vialis*).

Washington: Chebalis, *C. J. Humphrey*, 1287; Bingen, *W. N. Suksdorf*, 689.

4. *T. scissilis* Burt, n. sp.

Plate 4. fig. 8.

Type: in Burt Herb.

Fructifications gregarious, coriaceous, erect, clavariiform, branched, longitudinally ridged by the bases of numerous,

¹ A figure will be given in Part II.

small, appressed, acicular branches, the larger of which are at the apex of the fructification and spread slightly outward in fan-shaped manner; stem glabrous, castaneous; hymenium amphigenous, on upper half of the fructification, avellaneo-cinereous; basidia simple, hyaline, 4-spored; spores pale umbrinous under the microscope, angular, $6-8 \times 5-6\mu$.

Fructifications $1\frac{1}{2}$ –2 cm. high; spread of branches at the top 2–6 mm.; stem 7–10 mm. long, 1 mm. thick.

On the ground. Washington. January.

This species is very distinct by its slender erect habit, cinereous color, and only slightly spreading branches.

Specimens examined:

Washington: Bingen, Klickitat Co., *W. N. Suksdorf*, 716, type.

5. *T. angustata* Fries, (Nov. Symb. Myc. 92.) Actis R. Soc. Sc. Upsal. III. 1: 108. 1851.

Type: in Herb. Fries.

Fructification erect, cinereo-fuscos, pliant, becoming rigid and somewhat woody; stem elongated, radicated, rugose, glabrous, compressed, irregularly divided at the upper end into unequal, fastigiate, compressed branches, which are clothed on the whole outer surface with the hymenium; hymenium amphigenous, subrugose, gray; basidia simple; spores umbrinous under the microscope, obovoid, apiculate at base, flattened on one side, echinulate, $14 \times 7-9\mu$.

On decaying wood. Central America.

Substance, color, and hymenium exactly as in *T. cornucopioides*, but of the very different form of *Clavaria rugosa* and having highly branched forms; stem 5 cm. long; color fuliginous. The fructification is fleshy-pliant when fresh, but on drying hardens much more than species of *Stereum*.

Specimens examined:

Costa Rica: *Oersted* (in Herb. Fries), type.

6. *T. multipartita* Schw. in Fries, Elenchus Fung. 1: 166. 1828. Plate 4. fig. 7a.

Type: in Herb. Schweinitz.

Fructifications gregarious, erect, coriaceous, fusco-cinereous, usually drying pallid; pileus infundibuliform, sometimes cleft

more or less deeply and unequally into a few lobes, sometimes divided to the stem and spreading so as to appear dimidiate, very often deeply divided and subdivided into many narrow and spreading divisions more or less dilated and whitish at the apex; stem erect or incurved, equal or tapering upward, sometimes branched above, drying walnut-brown or pallid, villose; hymenium inferior, glabrous, even, fawn-color or vinaceous drab; spores unbrinous under the microscope, tuberculate, $7-9 \times 5-6\mu$.

Fructification $1\frac{1}{2}-3\frac{1}{2}$ cm. high, 1-3 cm. broad; stem 1-2 cm. long, 1-3 mm. thick.

On ground in groves of broad-leaved trees, especially under oak. New York and Pennsylvania to Illinois. July to September.

The upper surface of the pileus was originally described as glabrous, but it is minutely pubescent under a lens, or sometimes fibrillose. This species is very perplexing by its close relationship to *T. regularis*. The multipartite pileus is the only character which seems available to separate collections of the former from the latter species. If a given collection consists wholly of specimens with pileus many-parted and subdivided into narrow divisions, or if it contains some such specimens in addition to others with more regular infundibuliform pileus, I refer the collection to *T. multipartita*, as in the cases of the collections cited below from C. O. Smith and Dr. C. H. Peck respectively. As yet, I know of no characters by which to assort and separate into their respective species specimens mixed together of typical *T. regularis* and those specimens of *T. multipartita* which have the pileus infundibuliform or merely cleft more or less deeply and unequally into a few lobes. Therefore it is my opinion that *T. multipartita* is a variety of *T. regularis*, but the collections which have so far been submitted to me, have been composed of too few fructifications to assure me that this opinion is correct.

Specimens examined:

Exsiccati: Ell. & Ev., N. Am. Fungi, 2806, under the name *T. caryophyllea*.

New York: Bolton, *C. H. Peck*, 3, 4, 5; Ithaca, *C. O. Smith*, Cornell Univ. Herb., 13359, and *C. O. Smith and W. H. Long*, Cornell Univ. Herb., 7743.

New Jersey: Newfield, *J. B. Ellis*, Ell. & Ev., N. Am. Fungi, 2806.

Pennsylvania: on island in Lehigh River, *Schweinitz*, type (in Herb. Schw.); Bethlehem, *Schweinitz* (in Herb. Schw.), the *T. tuberosa* of Syn. N. Am. Fungi, 613; Trexlertown, *W. Herbst*, 22, 36.

Ohio: *A. P. Morgan*, Lloyd Herb., 2581, 2647; Oxford, *L. O. Overholts* (in Overholts Herb., 1685).

Illinois: River Forest, *E. T. and S. A. Harper*, 666.

7. *T. regularis* Schw. Schrift. d. Naturforsch. Gesell., Leipzig, 1: 105. 1822. Plate 4. figs. 6, 7b.

Thelephora Ravenelii Berk. Grevillea 1: 148. 1873.—*T. hiscens* Berk. & Rav. Grevillea 1: 148. 1873.

Type: in Herb. Schweinitz, Acad. Nat. Sci., Phila.

Pileus coriaceous, solitary, infundibuliform or divided to the stem into triangular divisions or flabelliform, fibrillose, drying pallid or tawny-olive, darker at center of the cup or at base of the divisions, margin lacerate; hymenium usually hair-brown, sometimes pallid; spores melleus to umbrinous under the microscope, angular-tuberculate, $6-7 \times 4\frac{1}{2}-5\mu$.

Fructification 6 mm.— $2\frac{1}{2}$ cm. high; pileus 5 mm.— $2\frac{1}{2}$ cm. broad; stem 3–15 mm. long, $1-1\frac{1}{2}$ mm. thick.

In moss in wet places and on humus. Ontario to Alabama and westward to Kansas.

The differences in form of the pileus of *T. regularis* are well shown by the type in Herb. Schweinitz; this type consists of three fructifications, two of which are infundibuliform, the third and largest, flabelliform. The hymenium is sometimes merely pallid, as in the case of the specimen which is the *T. pannosa* of Schweinitz, Syn. N. Am. Fungi, No. 606, but is not *T. pannosa* Fr. The cotypes of *T. Ravenelii* and *T. hiscens* agree in all respects with the authentic specimen of *T. regularis* in Curtis Herb. Specimens of *T. regularis* which have the pileus infundibuliform and little cleft are suggestive of small specimens of *T. caryophyllea* but differ from the latter by the thicker pileus

and paler coloration of *T. multipartita* which is wholly lacking in the rufescent coloration of *T. caryophyllea*. There is a difference of form between specimens of these two species which is brought out well by the figures in pl. 4.

Specimens examined:

Canada: Shannonville, Ontario, *J. Macoun*, 330.

Maine: Portage, *L. W. Riddle*, 4.

New Hampshire: Chocorua, *W. G. Farlow* (in Farlow Herb.).

Massachusetts: near Boston, *Sprague*, 246 (in Curtis Herb. under the name *T. anthocephala*); Newton, *W. G. Farlow* (in Farlow Herb.).

Pennsylvania: Bethlehem, *Schweinitz*, station cited by Schweinitz; also the specimen (in Herb. Schw.) under the name *T. pannosa* of Syn. N. Am. Fungi, No. 606; Trexlertown, *C. G. Lloyd*; Kitanning, *D. R. Sumstine*.

Delaware: Clayton, *H. S. Jackson*.

North Carolina: Salem, *Schweinitz*, type (in Herb. Schw.); *G. F. Atkinson*, Cornell Univ. Herb., 23254.

South Carolina: Greenville, *Ravenel*, 1498, type and cotype (in Kew Herb. and in Curtis Herb. respectively) of *T. Ravenelii* Berk.; Santee Canal, *Ravenel*, type and cotype (in Kew Herb. and in Curtis Herb. respectively) of *T. hiscens* Berk. & Rav.

Alabama: *Peters*, 576 bis (in Curtis Herb. under the name *T. anthocephala*).

Wisconsin: Madison, *W. Trelease* (in Farlow Herb.); Lake Geneva, *E. T. and S. A. Harper*, 882, and (in Harper Herb., 883).

Illinois: East St. Louis, *N. M. Glatfelter* (in Mo. Bot. Gard. Herb., 42563).

Iowa: Johnson County, *T. J. Fitzpatrick*, 39.

Missouri: St. Louis, *N. M. Glatfelter* (in Mo. Bot. Gard. Herb., 42564).

Kansas: Bourbon County, *A. O. Garrett*, 80.

8. *T. pusiola* Pat. in Duss, Champ. Guad. & Martinique 12. 1903.

Pileus with divisions triangular, white, hard, thin, entire or cut-lobed, glabrous, even or rugose, sometimes zonate, atten-

uated into a slender stem; stem colored like the pileus, glabrous, cylindric, woody; hymenium inferior, even, brown; basidia clavate, $25 \times 10\mu$, four-spored; spores globose-angular, colorless or somewhat fuliginous, 6μ in diameter; no cystidia.

Fructification 1 cm. high, divisions 5 mm. broad.

Solitary or in clusters on dead wood. Guadeloupe. Forest of Bains-Jaune, *Duss*, 589.

Var. *terrestris* Pat. *Ibid*, has the divisions of the pileus narrower, laciniate, divergent, rigid.

On the ground, Matouba, Guadeloupe, *Duss*.

I have seen no specimens of either this species or its variety, neither of which have been reported since their original discovery.

9. *T. caryophyllea* Schaeffer ex Fries, Syst. Myc. 1: 430. 1821. Plate 4. fig. 9.

Elvella caryophyllea Schaeffer, Icon. Fung. 3: 115. pl. 325. 1762-1774.—*Craterella ambigua* Pers. Obs. Myc. 1: 36. pl. 6. f. 8-10. 1796.—*Thelephora caryophylléa* γ *ambigua* Pers. Myc. Eur. 1: 112. 1822.

Illustrations: Schaeffer, Icon. Fung. pl. 325.—Persoon, Obs. Myc. 1: pl. 6. f. 8-10.—Schnizlein, in Sturm, Deutsch. Flora 3: fasc. 31. pl. 6.—Lanzi, Fungi di Roma pl. 11. f. 4.—Saunders and Smith, Myc. Ill. pl. 41. f. 7-12.—Smith, W. G. Brit. Basid. 399. f. 96 a, b.

Fructifications solitary or cespitose, coriaceous, fuscous purple but drying wood-brown; pileus infundibuliform, simple, or doubled by proliferous growth of smaller pilei from the disk of the principal pileus or of wedge-shaped lobes rising from its upper surface, upper surface radiately ridged or striate with masses of agglutinated fibers which are often dark colored, obscurely zonate when moist, margin incised; stem usually central, cylindric, villose, simple or branched; hymenium inferior, even, grayish olive to light yellowish olive; spores pale umbrinous, tuberculate, $7-8 \times 6\mu$.

Fructification $1\frac{1}{2}$ -5 cm. high, $1\frac{1}{2}$ -5 cm. broad; stem 1 cm. long, 2-3 mm. thick.

On the ground under pines. Canada to South Carolina and west to Ohio, also in the Pacific states. August to November. Abundant locally.

T. caryophyllea may be distinguished from our other northern species which have a central stem and dark hymenium, by the thin lobes of the pileus which dry paler than the hymenium, and by the frequent occurrence of specimens with the pileus consisting of many lobes and pilei imbricately arranged in a manner suggestive of a double pink or carnation, as shown by Schaeffer's fig. 5, and Persoon's fig. 10 of the illustrations cited. Our specimens agree well with the figures of Schaeffer and Persoon—those of Persoon are especially good but unfortunately occur in a work which is very rare.

We find occasionally specimens which agree well with *T. radiata* (Holmsk.) Fr., but these specimens are connected so closely by intermediate forms—often in the same collection—with others which are undoubtedly *T. caryophyllea* that I refer them to the latter species.

Specimens examined:

Sweden: *K. Starback*, in Romell, Fun. Scand., 121.

Canada: *J. Macoun*, 54 and 75 of 1903.

Quebec: Hull, *J. Macoun*, 190.

Ontario: London, *J. Dearness* (in Lloyd Herb.).

New Brunswick: Restigouche River, *T. F. Allen*, comm. by Dr. Farlow.

Maine: Orono, *L. W. Riddle*, 9.

New Hampshire: Shelburne, *W. G. Farlow*.

Vermont: Newfane, *C. D. Howe*; Middlebury, *E. A. Burt*, four collections.

Massachusetts: *Sprague*, 47, *Russell*, 131, and *D. Murray*, 545 (all in Curtis Herb.); Worcester, *G. E. Francis*, 105.

Connecticut: East Hartford, *C. C. Hanmer*, 1449; Central Village, *J. L. Sheldon*, 68, comm. by New York Bot. Gard.

New York: Bolton, *C. H. Peck*; Ithaca, *G. F. Atkinson*, 9993, 9994; Saranac Lake, *E. A. Burt*; East Galway, *E. A. Burt*.

Pennsylvania: Bethlehem, *Schweinitz* (in Herb. Schw.), the 608 of Syn. N. Am. Fungi.

Dist. of Columbia: Zoölogical Park, *Coville and Cook*, No. A, comm. by P. L. Ricker.

North Carolina: *Schweinitz* (in Herb. Schw.).

Michigan: *C. G. Lloyd*, 4547; Sailor's Encampment, *E. T. and S. A. Harper*, 439, and Univ. of Wis. Herb., 2.

Ohio: *C. G. Lloyd*, 1422, 2720; Cincinnati, *A. P. Morgan*, Lloyd Herb., 2641, and (in Lloyd Herb., 1152); Loveland, *D. L. James* (in Herb. U. S. Dept. Ag.).

Kentucky: *C. G. Lloyd*, 1152.

Washington: Bingen, *W. N. Suksdorf*, 717, 690.

California: Jackson, *J. H. Barber*, comm. by *W. A. Setchell*; Stanford University, *C. F. Baker*, 255, distributed by Baker, Pacific Slope Fungi, 3743, under the name *T. radiata* (Holmsk.) Fr.

10. *T. magnispora* Burt, n. sp.

Plate 4. fig. 5.

Type: in Burt Herb.

Fructifications solitary or gregarious, coriaceous, stipitate; pileus irregularly infundibuliform, somewhat tubular, with ascending recurved lobes, drying avellaneous, becoming fuscous at the center with age, fibrous torn becoming radiately striate, margin incised; stem equal, solid, drying hard, irregularly angled, sulcate and pitted, vinaceous brown to drab; hymenium inferior, even, vinaceous brown; basidia simple; spores pale cinnamon, subglobose, echinulate, 10–14 μ in diameter.

Fructification 2–4 cm. high; pileus 1–2 cm. in diameter; stem 7–12 mm. long, 2–5 mm. thick.

On mossy ground. Chester Vale, Jamaica. December.

In some of the specimens the pileus is decidedly eccentric through greater growth on one side than on the other, and it is not always lobed. The offensive odor of the dried specimens and the color of the hymenium are suggestive of *T. cuticularis*.

Specimens examined:

Jamaica: Chester Vale, *W. A. and Edna L. Murrill*, type, New York Bot. Gard., Fungi of Jamaica, 295.

11. *T. corbiformis* Fries, (Nov. Symb. Myc. 92.) Actis. R. Soc. Sc. Upsal. III. 1: 108. 1851.—Romell, Hymenomycetes Austro-Americani. Bihang till K. Sv. Vet.-Akad. Handl. 26¹⁶: Afd. III. 44. 1901.

Type: in Herb. Fries.

Fructification sessile, rigid, cinereo-fuscous, with cespitose lobes of which the outer ascend and coalesce into a rounded

cupulate pileus here and there lacunose-pervious, and the inner are distinct, crowded, erect, narrow; hymenium inferior, uneven, whitish; basidia simple; spores slightly colored, becoming uneven, ovoid, $5-6 \times 4-5 \mu$.

On the ground. Costa Rica and Brazil. January.

"In substance, texture, color, etc., this species agrees exactly with *Thel. cornucopioides* and *Thel. angustata* but in form it exhibits a type unique in the Hymenomycetes. The clusters are regularly rounded, very dense, divided all the way to the base into innumerable lobes, of which the interior are free and erect, the exterior regularly ascendant, broader, compressed, clothed underneath by the hymenium and grown together into a cup here and there lacunose-pervious, undulate-crisped at the apex and fimbriate."—Translation of the original comment on this species.

In 1899, I found the type in Herb. Fries to be cinereo-pallid with a slight fuscous tinge and with basidia and spores as stated above but many of the spores even. Romell describes the spores of his specimens from Brazil as "hyalinæ, laeves, ellips., $5-7 \times 3-4$ mmm.," and as agreeing with the type. I have reexamined my sections from the type; the spores are certainly colored and many of them rough-walled.

Specimens examined:

Costa Rica: San José, *Oersted* (in Herb. Fries, Univ. Upsal.), type.

12. *T. cornucopioides* Fries, (Nov. Symb. Myc. 91.) Actis R. Soc. Sc. Upsal. III. 1: 107. 1851.¹

Type: not known to be in existence; not in Herb. Fries, at Upsala, nor in Kew Herb.

Pileus pliant becoming rigid, deeply infundibuliform, $5-7\frac{1}{2}$ cm. broad, radiately rugose, glabrous, fuscous; stem solid, rather glabrous, pallid; hymenium inferior, somewhat rugose, gray.

On the ground. Near San José, Costa Rica.

This species bears so singular a resemblance to *Craterellus cornucopioides* that from pictures they are scarcely to be distinguished. The present species has the stem truly solid and the substance fleshy pliant when living, nearly stony-woody when dry; stem $5-7\frac{1}{2}$ cm. long, 4-6 mm. thick, equal or attenu-

¹ A figure will be given in Part II.

ated at the base, compressed, rather glabrous, very tough, pallid; pileus membranaceous-cartilaginous, when dry quite rigid, radiately rugose, with the ridges elevated towards the undulate and at first fimbriate margin, not zonate after the manner of species of *Stereum*; hymenium inferior, hardened. Related to *Cladoderris*.

I refer to *T. cornucopioides* a collection made in Jamaica by Prof. F. S. Earle, in 1902, the specimens of which agree well with the original description, as translated above, except in size. They are 3–3½ cm. high and 2 cm. broad with stem about 1 cm. long by 2–4 mm. thick. The dried fructification is very hard and stony and softens so little with water that the edge of the razor is turned in sectioning. The spores are colorless and even at first and become slightly colored and angular, 9–10 x 6μ.

Specimens examined:

Jamaica: Castleton Gardens, F. S. Earle, New York Bot. Gard.,
Plants of Jamaica, 238.

13. *T. vialis* Schw. (Syn. N. Am. Fungi) Trans. Am. Phil. Soc. N. S. 4: 165. 1834. Plate 5. fig. 15.

T. tephroleuca B. & C. Grevillea 1:149. 1873.

Type: in Herb. Schweinitz.

Fructification coriaceous, dirty whitish or pallid, sometimes wood-brown at the center, upper surface usually radiately plicate or rough with masses of agglutinated fibers; pileus polymorphic, sometimes composed of ascending lobes or small pilei which arise from a common base and grow together above to form a broad cup, or sometimes with the whole interior of the cup filled with small pilei and lobes many of which arise proliferously from the upper surface of the outer lobes; stem central when present; hymenium inferior, rugose, somewhat papillose, yellowish pallid becoming avellaneous or somewhat fuscous; spores olive-buff under the microscope, bluntly angular (i. e., tips of the angles obtuse), 4½–7. x 4½–5μ.

Fructification 2½–5 or 6 cm. high, 2½–7 cm. broad.

On ground in frondose woods. Vermont to South Carolina and west to Illinois. September.

This is a fine, large species well marked by the dirty whitish or yellowish, fibrillose upper surface of the pileus, thick substance of the same color unless the specimen is old, and the brown,

slightly wrinkled hymenium. As in the otherwise very different *T. caryophyllea*, large specimens sometimes resemble a double flower from the great number of small pileoli and lobes present in the center. Schweinitz described the species as sometimes having dimidiate pilei, but I have seen no such specimens. My collection assumed a disagreeable odor in drying but no such odor has been noted by others.

Specimens examined:

Exsiccati: Ell. & Ev., N. Am. Fungi, 1110, and Fun. Col., 1593, in both under the name *T. caespitulans*.

Vermont: Lake Dunmore, *E. A. Burt*.

New Jersey: Newfield, *J. B. Ellis* (in Mo. Bot. Gard. Herb., 5155), also in the exsiccati cited.

Pennsylvania: Bethlehem, *Schweinitz*, type (in Herb. Schw.); *Michener*, 1504 (in Curtis Herb. and in Kew Herb.), the cotype and type respectively of *T. tephroleuca*; Trexlertown, *W. Herbst*, 43, *C. G. Lloyd and W. Herbst*, 2866, 3088 (both in Lloyd Herb.); *N. M. Glatfelter* (in Mo. Bot. Gard. Herb., 42561).

Dist. of Columbia: Washington, *F. J. Braendle*, comm. by C. H. Peck.

North Carolina: *G. F. Atkinson* (in Cornell Univ. Herb., 23253); Asheville, *H. C. Beardslee*; Schweinitz cited North Carolina as a station.

South Carolina: Caesar's Head, *Ravenel*, one of the types (in Curtis Herb. and Kew Herb.) of *T. tephroleuca*.

Ohio: *C. G. Lloyd*, 4000.

Illinois: Glen Ellen, *E. T. and S. A. Harper*, 669.

14. *T. albido-brunnea* Schw. Trans. Am. Phil. Soc. N. S. 4: 166. 1834. Plate 5. fig. 13.

Stereum Micheneri B. & C. Grevillea 1: 162. 1873 (in part).—*Stereum spongiosum* Masee, Jour. Linn. Soc. Bot. 27: 172. 1889.—*Thelephora odorifera* Peck, Rep. N. Y. State Mus. 44: 132 (22). 1891.

Type: in Herb. Schweinitz.

Pileus sessile or with very short stem, coriaceous, spongy when dry, uniformly cinnamon-buff or with the older portions chestnut-brown, sometimes assuming mesopod form when encircling small twigs or shrubs, sometimes effuso-reflexed, usually dimidi-

ate and somewhat imbricated, fibrous-tomentose, margin thick and entire; substance concolorous with the upper surface, spongy, more than 2 mm. thick, with hyphae $4\frac{1}{2}$ – 5μ in diameter; hymenium inferior, even, not polished, cinnamon-buff; basidia simple; spores deep olive-buff under the microscope, echinulate, 8 – 10×6 – 8μ .

Pileus 2–4 cm. in diameter when circular, or 1 – $2\frac{1}{2}$ cm. long, 2–4 cm. broad, often 1 cm. thick at base when dimidiate.

Running up and encircling twigs on the ground and against the base of shrubs. Canada to Louisiana and west to Wisconsin. August.

Peck describes the odor as quite fragrant at first but states that it is lost after a few weeks; I did not notice any especial odor for my collection. *T. albido-brunnea* may be distinguished from our other dimidiate and reflexed species of *Thelephora* by its even and pale hymenium and thick spongy pileus. Schweinitz confused one collection of this species with *T. biennis* Fr., from the specimen of which in the Fries Herbarium, at Upsala, it is clearly distinct. The types of *Stereum spongiosum* Masee, viz., Curtis, 3582, and Ravenel, 1732, in Kew Herbarium, have colored echinulate spores 8 – 10×6 – 7μ , although described by Masee as “ellipsoideæ 6 – $7 \times 4\mu$ ” without mention of color and projections of the wall. The type of *Thelephora odorifera* Peck, in Coll. N. Y. State, is somewhat bleached or faded but quite typical.

Specimens examined:

Exsiccati: Ravenel, Fun. Car. IV, 12, the type distribution of *T.*

Micheneri B. & C.; Ell. & Ev., N. Am. Fungi, 1599, and

Fun. Col., 1209, under the name *T. Micheneri* in both.

Canada: Toronto, *J. Dearness* (in Lloyd Herb.).

Vermont: Lake Dunmore, *E. A. Burt*.

New York: Selkirk, *C. H. Peck* (in Coll. N. Y. State), the type of *T. odorifera* Pk.; Alcove, *C. L. Shear*, 1010, 1163, 1184; Jamesville, *L. M. Underwood*.

Pennsylvania: Bethlehem, *Schweinitz* (in Herb. Schw.), the type, and also the Nos. 627 and 625 of Syn. N. Am. Fungi under the names respectively of *T. biennis* and *T. laciniata*; Michener (in Curtis Herb., 3582, and also in Kew Herb., same number), type of *Stereum spongiosum* Masee; Trexlertown, *W. Herbst*, 18, and (in Lloyd Herb., 3052).

North Carolina: Blowing Rock, *G. F. Atkinson*, 4322.

South Carolina: *Ravenel*, 790 (in Curtis Herb. and in Kew Herb.), under the name *Thelephora biennis*; Santee Canal, *Ravenel*, 1732 (in Curtis Herb. and in Kew Herb.), type of *Stereum spongiosum* Massee.

Louisiana: Bogalusa, *C. J. Humphrey*, 466.

Ohio: Cincinnati, *A. P. Morgan*, Lloyd Herb., 2627.

Michigan: Saugatuck, *E. A. and S. A. Harper*, 654.

Wisconsin: Milwaukee Co., comm. by Mrs. F. W. Patterson.

15. *T. lutosa* Schw. Trans. Am. Phil. Soc. N. S. 4: 166. 1834.¹

Type: in Herb. Schweinitz.

Pilei cespitose, densely imbricated, at first somewhat fleshy but at length hard, undulate-plicate, yellowish, almost sub-tomentose with pulverulence, somewhat horizontally attenuated behind, margin sublobate, at length inflexed; pileus less than 2 mm. thick, with hyphae 3μ in diameter; hymenium becoming yellowish, even; spores olive-buff under the microscope, angular, $5-6 \times 3\frac{1}{2}-4\mu$.

Cluster about $1\frac{1}{2}$ cm. high and broad.

On the ground in roads and in woods. North Carolina.

The type is distinct from *T. albido-brunnea*, having thinner pileus, finer hyphae, and smaller and paler spores. The pilei were crowded together into a small buff-colored cluster about $1\frac{1}{2}$ cm. high and broad, somewhat as in *Tremellodendron pallidum* (Schw.); I failed to find stems at their bases.

Specimens examined:

North Carolina: Salem, *Schweinitz* (in Herb. Schw.), type.

16. *T. cuticularis* Berk. Hooker's Lond. Jour. Bot. 6: 324. 1847. Republished in Lea, Catalogue of Plants in Vicinity of Cincinnati 66. d. 1849. Plate 5. fig. 14.

Type: in Kew Herb., and a portion of it from Berkeley in Curtis Herb.

Pilei coriaceous-soft, effuso-reflexed or dimidiate, imbricate, sometimes laterally confluent, drying pinkish buff to cinnamon-brown, with a broad, pale margin, surface radiately rugose, soft, silky fibrillose; substance of the same color as pileus; hymenium inferior, concave, even, drab to brownish drab; spores umbrinous under the microscope, flattened on one side or somewhat kidney-shaped, not angular, echinulate, $8-9 \times 6-7\mu$.

¹ A figure will be given in Part II.

Pileus 1–1½ cm. long, 2–4 cm. broad, 1 mm. thick.

On mossy bark at the base of trees and on fallen twigs in groves. Vermont to Texas and west to Missouri. June to August.

In his description Berkeley noted that the odor of this species is strong and unpleasant; my specimens retained such an odor for several years but I did not notice it before they were dried. *T. cuticularis* may be distinguished from our other species by its drab hymenium, portions of which become sage-green when crushed under a cover glass in a 7 per cent solution of potassium hydrate, and by its spores, which are not at all angular or irregular as regards the main body of the spore, but ovoid and flattened on one side or slightly kidney-shaped and sparingly studded with slender spines.

Specimens examined:

Vermont: Middlebury, *E. A. Burt*.

Rhode Island: *Olney*, 1851 (in Kew Herb. and in Curtis Herb.).

Pennsylvania: Bethlehem, *Schweinitz* (in Herb. Schw.), the Nos. 628 and 629 of Syn. N. Am. Fungi, under the names respectively of *T. fuscocinerea*, and *T. gausapata*; Kitanning, *D. R. Sumstine*, 1.

Delaware: Newark, *H. S. Jackson*.

North Carolina: Asheville, *H. C. Beardslee*, 03195.

Florida: *Mrs. Sams*, comm. by C. G. Lloyd.

Texas: *W. H. Long, Jr.*, 351, 387 (in Cornell Univ. Herb.).

Ohio: Waynesville, *T. G. Lea* (in Kew Herb.), type; Preston, *A. P. and L. V. Morgan*, comm. by C. G. Lloyd, also *C. G. Lloyd*, specimen dated July 26, 1896; Cincinnati, *C. G. Lloyd*, 4492.

Wisconsin: Blue Mounds, *E. T. and S. A. Harper*, 861.

Missouri: Columbia, *B. M. Duggar*, 289.

17. *T. intybacea* Pers. ex Fries, Syst. Myc. 1: 431. 1821.

Plate 5. fig. 11.

T. intybacea Pers. Syn. Fung. 567. 1801–1807; Myc. Eur. 1: 110. 1822.

Illustrations: Bulliard, Champ. de la France pl. 278.—Bigeard et Guillemin, Champ. Super. France 436. pl. 44. f. 1.

Fructifications cespitose, soft, whitish, then rufous-ferruginous, drying chestnut-brown to Rood's brown, with stems

somewhat lateral and growing into one another; pilei imbricated, fibrous, usually with the fibers matted and agglutinated into appressed and wholly adnate squamules, margin dilated and whitish-fimbriate at first, at length becoming entire and colored like the rest of the pileus; hymenium inferior, concolorous with the upper surface, papillose; spores concolorous with hymenium, snuff-brown under the microscope, angular-tuberculate, 7-9 x 6-8 μ .

Clusters often 5-8 cm. in diameter; individual pileus 2-3 cm. long, 2-4 cm. broad, 1 mm. thick.

On the ground in pine woods, growing up from the layer of fallen leaves. Ontario to North Carolina and westward to Ohio and Michigan. August to October.

The clusters are sometimes central but more often with the pilei lateral and triangular; sometimes the mass ascends small sticks and then extends out from this support in reflexed forms; the upper surface is usually uneven and dries somewhat depressed between the adnate squamules. This species is distinguished from ferruginous specimens of *T. terrestris* by the thicker and entire margin of the pileus and by the absence of free squamules.

Specimens examined:

Exsiccati: Ell. & Ev., Fun. Col., 1410.

Austria: *G. Bresadola*.

Ontario: Toronto, *J. Dearness*, comm. by C. G. Lloyd; Harraby, Lake Rosseau, *E. T. and S. A. Harper*, 682.

Maine: Portage, *L. W. Riddle*, 3.

New Hampshire: Shelburne, *W. G. Farlow*.

Vermont: Middlebury, Sudbury, Grand View Mt., *E. A. Burt*.

Massachusetts: *A. P. D. Piguet*, comm. by Dr. Farlow; Natick, *G. E. Morris*, No. E.

Connecticut: East Hartford, *C. C. Hanmer*, 1434.

New York: Alcove, *C. L. Shear*, 1009; East Galway, *E. A. Burt*; Ithaca, *G. F. Atkinson*, Cornell Univ. Herb., 3050, 19652.

Dist. of Columbia: Takoma Park, *C. L. Shear*, 799, 796; Washington, *O. F. Cook*, 4, comm. by P. L. Ricker.

North Carolina: Asheville, *H. C. Beardslee*, 0341.

Ohio: *A. P. Morgan* (in Lloyd Herb.).

Michigan: *C. G. Lloyd*, 4546; Lawton, *L. A. Hawkins*; Sailor's Encampment, *Allen and Stuntz*, 1, Univ. of Wis. Herb.

18. *T. terrestris* Ehrh. ex Fries, Syst. Myc. 1: 431. 1822.

Plate 5. fig. 10.

T. terrestris Ehrh. Crypt. Exsicc. No. 178. 1785.—Persoon, Syn. Fung. 566. 1801; Myc. Eur. 1: 113. 1822.—*Stereum laciniatum* Pers. Obs. Myc. 1: 36. 1796.—*Thelephora laciniata* Pers. Syn. Fung. 567. 1801.—*T. caryophyllea* β *laciniata* Pers. Myc. Eur. 1: 112. 1822.—*T. laciniata* Fries, Syst. Myc. 1: 431. 1821.

Illustrations: Batsch, Elenchus Fung. pl. 24. f. 121.—Nees, System der Pilze pl. 34. f. 251.—Bolton, Hist. Fung. pl. 173.—Sowerby, Col. Fig. of Eng. Fungi pl. 213.—Cooke, Handbook 1: 310.—Stevenson, Brit. Hym. 2: 261.—Smith, Brit. Basid. 399. f. 96 C-E.

Fructifications dark fuscous to fawn-color, coriaceous-soft, cespitose, obconic, with a short stem-like base, or dimidiate and sessile, or incrusting and effuso-reflexed; pileoli more or less imbricated, sometimes laterally confluent, fibrous-squamulose and usually strigose, thin, margin fibrous-fimbriate and lacinate; hymenium inferior, papillose, fuscous to fawn-color; spores pale fuscous, irregular, angular, sometimes slightly tuberculate, 6–9 x 6 μ .

Clusters 5–8 cm. in diameter, with single pileolus about 3 cm. long and broad; obconic pileus 2–3 cm. in diameter; dimidiate pileolus 1½–2 cm. long, 2–3 cm. broad, about 1 mm. thick.

On sandy ground in bare fields and at base of trunks and from fallen twigs and leaves in pine woods. Canada to South Carolina, and in Michigan, Jamaica, and Alaska. July to December.

My observations of this species acquired from specimens received and from seeing it growing abundantly near Middle Grove, N. Y., seem to show that the medium from which this fungus derives its food produces an interesting effect on the fructification. Growing from bare, sandy ground the fructifications are dark fuscous in color, and may be flattened clusters of imbricated pileoli, or of the obconic-pileus type composed of ascending pileoli confluent laterally, or dimidiate, sessile pileoli. When growing on abundant woody matter, as is the case in the specimen in Sowerby's illustration already cited, the fructification assumes a redder color and replaces its dimidiate, sessile pileus on earth by a reflexed one on the wood. With regard to

other forms of the clusters and pileoli, the covering of the upper surface, and the spore characters there is no difference between those fructifications produced without woody food and those having it. There is no sharp color separation between these color extremes.

Specimens growing on the ground usually have a short stem-like base, while those growing on wood are reflexed; the same collection may show both these conditions, as, for example, that from Skagway, Alaska, if some of the fructifications start from sticks and others directly from the ground. Persoon regarded the stem in *T. terrestris* as the chief character separating that species from his *T. laciniata*, as may be seen from his own descriptions contrasting the two in his 'Synopsis Fungorum,' pp. 566 and 567, as follows:

"3. THEL. TERRESTRIS: subimbricata obscure fusca, pileo applanato fibroso-strigoso."

"Hab. in arenosis ad terram. *Stipes* brevis, lateralis omnino adest. Substantia submollis, non ita coriacea sicca, vti in ceteris speciebus."

"4. THEL. LACINIATA: imbricata obscure fusca, pileo tenui laciniato crispo subtus papillis congestis scabro."

"Hab. ad radices truncorum. Cespitem difformem efformat, 2 vnc. lata, tenuis. *Stip.* vix adest distinctus."

These descriptions supplement each other as a description for one species; each has special application to fructifications growing side by side under such conditions as to show that they are from a common mycelium. Persoon never claimed that his species differed from *T. terrestris* in color. Fries gave a different description of *T. laciniata* in his works cited—to the injury of *T. intybacea*—, but the characters he gives are not satisfactory. European mycologists with a wide knowledge of the *Thelephoraceæ* as they grow are unable to distinguish these two species. In letters to me, Bresadola regards *T. laciniata* as a synonym of *T. terrestris*; and Romell does not know *T. terrestris* if it is distinct from *T. laciniata*.

Specimens examined:

Exsiccati: Ellis, N. Am. Fungi, 511; Ell. & Ev., N. Am. Fungi, 2732, under the name *T. intybacea*.

Austria: G. Bresadola.

Sweden: G. Romell, 52, 55, 56, 57.

Newfoundland: A. C. Waghorne, 276 (in Mo. Bot. Gard. Herb.).

Quebec: Gaspe, *J. Macoun*, 229.

Ontario: Ottawa and Belleville, *J. Macoun*.

Maine: Wells, *J. Blake*, comm. by P. L. Ricker.

New Hampshire: Chocorua, *W. G. Farlow*.

Massachusetts: Magnolia and Woods Hole, *W. G. Farlow*; Ipswich, *G. E. Morris*, No. F.

Connecticut: South Windsor, East Hartford, and Rockville, *C. C. Hanmer*, 1227-29, 944, 1057.

New York: East Galway and Middle Grove, *E. A. Burt*, three collections from the latter station; Ithaca, *G. F. Atkinson*, Cornell Univ. Herb., 22976.

New Jersey: Belleplain, *C. L. Shear*, 1246; Newfield, *J. B. Ellis*, Ellis, N. Am. Fungi, 511.

Pennsylvania: *Schweinitz* (in Herb. Schw.), the 624 of Syn. N. Am. Fungi.

North Carolina: Asheville, *H. C. Beardslee*, 02280; Salem, *Schweinitz* (in Herb. Schw.), the 624 of Syn. N. Am. Fungi.

Alabama: Tuskegee, *Beaumont*, 199 (in Curtis Herb.).

South Carolina: Society Hill, *M. A. Curtis*, 2693 (in Curtis Herb.).

Michigan: Agricultural College, *G. H. Hicks*, Ell. & Ev., Fun. Col., 2732.

Alaska: Skagway, *J. Macoun*, 47; *Evans*, 410 (in Mo. Bot. Gard. Herb.).

Jamaica: Cinchona, *W. A. and E. L. Merrill*, New York Bot. Gard., Fun. of Jamaica, 451.

19. *T. griseozonata* Cooke, *Grevillea* 19: 104. 1891.

Plate 5. fig. 12.

Type: in Ravenel, Fun. Amer., 444.

Fructifications cespitose, coriaceous-soft; pileoli extended into a short sublateral stem, imbricate, applanate, silky-strigose, zonate with alternating cervine (Rood's brown) and light buff zones, margin subfimbriate; hymenium inferior, castaneous when fresh, drying Rood's brown, rugose, somewhat papillose; spores pale fuscous, angular, 6-9 x 6-7 μ .

Cluster 3-6 cm. in diameter; obconic pileus and single pileolus each 2-3 cm. in diameter.

On sandy ground in pine woods. New Jersey to Louisiana. August to November.

This species is closely related to *T. terrestris* and has the same habitat, habit of growth, and spore characters, but is distinguished from that species by its zonate pileus. The fructifications usually occur in flattened clusters with spreading pileoli; sometimes the individual pileoli acquire an infundibuliform appearance by the growing together for part of their length of opposite edges of individual pileoli; sometimes a small obconic pileus occurs composed of two or more pileoli with adjacent edges confluent. In the collection cited below from Mississippi, small lobes are present in the cavity of the cup, as in *T. vialis* and *T. caryophyllea*.

Specimens examined:

Exsiccati: Ravenel, Fungi Am., 444, type distribution; Ravenel, Fun. Car. II, 28, under the name *T. caryophyllea*; Ellis, N. Am. Fungi, 714; Ell. & Ev., Fun. Col., 1305.

New Jersey: Newfield, J. B. Ellis, in his exsiccati cited.

South Carolina: Aiken, H. W. Ravenel, Fungi Am., 444, type collection.

Alabama: Auburn, C. F. Baker, Lloyd Herb., 3462.

Mississippi: Biloxi, Mrs. E. S. Earle, 32.

Louisiana: St. Martinville, A. B. Langlois, *by*.

20. *T. fimbriata* Schw. ex Schweinitz, Trans. Am. Phil. Soc. N. S. 4: 166. 1834. Plate 4. fig. 3.

Merisma fimbriatum Schw. (Syn. Fung. Car., No. 1067) Schrift. d. Naturforsch. Gesell., Leipzig, 1: 110. 1822.—*Thelephora scoparia* Peck, Rep. N. Y. State Mus. 42: 123 (27). *pl. 2. f. 20, 21.* 1889.

Illustrations: Peck, Rep. N. Y. State Mus. 42: *pl. 2. f. 20, 21.*

Type: in Herb. Schweinitz.

Fructification coriaceous-soft, incrusting and ascending small plants (mosses, etc.), here and there emitting fascicles of branches united below, subterete, acuminate or fimbriately incised, at first pale or whitish, soon ferruginous brown, drying Rood's brown; hymenium even, pruinose-pubescent; spores umbrinous, tuberculate, 7–11 x 6–9 μ .

Incrusting and ascending upward 1–3 cm.; free branches 5–10 mm. long, 1 mm. thick, sweep of fascicle about 5–10 mm.

In moist places. New York to South Carolina, and west to Illinois. July and August.

The type is an incrusting specimen, covering as its main axis a small twig in one specimen and a moss in the other, and sending out a few lateral branches which are flattened towards the free ends and subfimbriate; main trunk is cylindric, lateritious (of 'Chromotaxia'), ends of branches paler; spores umbrinous under the microscope, tuberculate, 7–8 x 6 μ . Schweinitz described the species as becoming hard and cartilaginous, but this is an error probably due to the foreign matter surrounded by the main trunk. Several other specimens are present in his herbarium under various names.

Specimens examined:

Exsiccati: Ellis, N. Am. Fungi, 512, under the name *T. cristata*. Massachusetts: Weston, A. B. Seymour, *T* 1 (in Mo. Bot. Gard. Herb., 45573).

New York: Bethlehem and Selkirk, C. H. Peck (in Coll. N. Y. State), type of *T. scoparia*; Syracuse, from Herb. Cornell Univ., 19474.

New Jersey: Newfield, J. B. Ellis, N. Am. Fungi, 512.

Pennsylvania: Bethlehem, Schweinitz (in Herb. Schw.), the 615 of Syn. N. Am. Fungi, under the name *T. stabularis*.

North Carolina: Salem, Schweinitz (in Herb. Schw.), type, and also the 1063 of Syn. Fung. Car., under the name *Merisma fuscescens*.

Indiana: Millers, E. T. and S. A. Harper, 670.

Illinois: Havana, H. C. Beardslee; Riverside, E. T. and S. A. Harper, 668.

21. *T. perplexa* Burt, n. sp.¹

Type: in Curtis Herb.

Fructification incrusting, coriaceous, consisting of a resupinate membrane from the central portion of which arise cylindric trunks either simple or digitately branched; resupinate portion spongy; firm, separable, fuscous at the center, margin thin, determinate, pinkish buff; ascending portions spongy, firm,

¹ A figure will be given in Part II.

fuscous, simple and tapering upward or soon branching and terminating in paler either subulate tips or somewhat flattened ends; spores fuscous, subglobose, echinulate, $8-10 \times 8-9\mu$.

The resupinate membrane may be 3 cm. in diameter; ascending portion of fructification 2-3 cm. high, $1\frac{1}{2}$ -2 mm. thick.

On decaying leaves and sticks on the ground. Cuba.

Berkeley & Curtis based their description of *Thelephora dentosa* on two collections made in Cuba by C. Wright in different years; these collections are different specifically. The original description applies chiefly to the earlier collection, made in 1857, which is unnumbered. I take my type of *T. perplexa* from the later collection, *C. Wright, 238*.

Specimens examined:

Exsiccati: Fungi Cubenses Wrightiani, *C. Wright, 238*, under the name *Thelephora dentosa* B. & C.

Cuba: *C. Wright, 238*, type (in Curtis Herb.).

22. *T. dentosa* Berk. & Curtis emend Burt.¹

T. dentosa B. & C. (Fungi Cubenses) Jour. Linn. Soc. Bot. 10: 329. 1867.

Type: type and cotype in Kew Herb. and Curtis Herb. respectively.

Fructification coriaceous-soft, incrusting leaves and small twigs on the ground and ascending as free, sessile, dilated, triangular, flabelliform pilei which are dentate at the upper end or deeply divided into a few finger-shaped divisions, honey-yellow to tawny olivaceous throughout, minutely hairy under a lens; spores honey-yellow, globose to ovoid, weakly echinulate, $6-10 \times 6-8\mu$.

Pileus 1 cm. high, 5 mm.-1 cm. broad.

On rotten vegetation. Cuba. June.

As already stated in connection with *T. perplexa*, Berkeley & Curtis cited for types of their *T. dentosa* specimens from two collections made in Cuba by C. Wright. These collections were made with an interval of several years between the collections, which differ specifically. As noted by Berkeley & Curtis, their description applies better to the earlier collection, to which I now

¹ A figure will be given in Part II.

restrict their species. This earlier collection was distributed by C. Wright, unnumbered, under the name *Thelephora dentosa* B. & C. before the publication of the description of this species, and the cotype in Curtis Herb. is unnumbered also. By what was apparently a slip of the pen, Berkeley cited this type as *C. Wright, 507*. By the kindness of Dr. Farlow I have been permitted to examine the manuscript records which show that Wright collected only one No. 507, which was determined by Berkeley as *Xylaria obovata* Berk. and is cited under this species by Berk. & Curtis, Jour. Linn. Soc. Bot. 10: 380. 1867. I find in Curtis Herb. such a specimen labelled *Xylaria obovata* Berk., Cuba, *C. Wright, 507*. I conclude that the type and cotype of *T. dentosa* B. & C., first cited in their description, are from the collection distributed by C. Wright, unnumbered, under the name *Thelephora dentosa* B. & C.

Specimens examined:

Exsiccati: Plantae Cubenses Wrightianae, unnumbered, under the name *Thelephora dentosa* B. & C.

Cuba: *C. Wright*, cotype (in Curtis Herb.).

23. *T. spiculosa* Fries, Syst. Myc. 1: 434. 1821; Epicr. Syst. Myc. 539. 1836-38. Plate 4. fig. 2.

Illustrations: Persoon, Syn. Fung. pl. 3. f. 16.

Type: an authentic specimen from Fries, in Kew Herb.

Fructifications cespitose, from byssoid becoming fleshy, variable by incrusting habit, pale buff at first, main portions becoming purplish-fuscous (Rood's brown) with age, ramose-spiculous, tips penicillate and whitish; spores umbrinous under the microscope, irregular, echinulate, 8-9 x 6-7 μ .

Clusters 1-2 cm. high, 2-4 cm. in diameter, single fructification 1-2 cm. high, about 1 mm. in diameter, with branches spreading 4-6 mm.

On leaves on ground in moist groves. Ohio to Wisconsin. July. Rare.

The best specimens which I have seen have main trunks of the fructifications running side by side over partially decayed beech leaves and confluent into an effused mass. These trunks ascend obliquely from the leaves to a height of 1-2 cm., branch sparingly, and terminate in spiculous tips. The fructification

must be inconspicuous in the woods since the general color of the mass is the same as that of the leaves on which it is effused, although the main trunks may be darker.

Specimens examined:

Exsiccati: Kunze, Fun. Sel. Exsic., 560.

Sweden: specimen from Fries (in Kew Herb.).

Austria: *G. Bresadola*.

Ohio: Preston, *C. G. Lloyd*.

Michigan: Glen Lake, *C. G. Lloyd*, 02471.

Wisconsin: Lake Geneva, *E. T. and S. A. Harper*, 883.

(To be continued.)

EXPLANATION OF PLATE

PLATE 4

All figures of plates 4 and 5 have been reproduced natural size from photographs of dried herbarium specimens of species of *Thelephora*.

Fig. 1. *Thelephora anthocephala*. From specimen collected at Linwood, Ohio, by C. G. Lloyd, No. 02164.

Fig. 2. *T. spiculosa*. *a*, from specimen on leaves of *Fagus* collected in Europe by Bresadola, which I compared with the specimen from Fries in Kew Herbarium; *b*, from specimen collected at Glen Lake, Mich., by C. G. Lloyd, No. 02471.

Fig. 3. *T. fimbriata*. From specimen incrusting living strawberry (*Fragaria*) plant, collected at Riverside, Ill., by E. T. and S. A. Harper, No. 668.

Fig. 4. *T. palmata*. From specimen from New Jersey, from C. G. Lloyd, No. 4612.

Fig. 5. *T. magnispora*. From type specimens collected at Chester Vale, Jamaica, by W. A. and Edna L. Murrill, No. 295. *a* shows upper surface and side of pileus, and *b*, the hymenium.

Fig. 6. *T. regularis*. From a sketch of the type in Herb. Schweinitz.

Fig. 7 *a*. *T. multipartita*. From specimens collected at Trexlertown, Pa., by Dr. W. Herbst.

Fig. 7 *b*. *T. regularis*. From specimens collected at Clayton, Del., by H. S. Jackson.

Fig. 8. *T. scissilis*. From type specimens collected at Bingen, Wash., by W. N. Suksdorf, No. 716.

Fig. 9. *T. caryophyllea*. From specimens collected in Michigan, by C. G. Lloyd, No. 4547.



BURT—THELEPHORACEAE OF NORTH AMERICA

1. *THELEPHORA ANTHOCEPHALA*.—2. *T. SPICULOSA*.—3. *T. FIMBRIATA*.—
 4. *T. PALMATA*.—5. *T. MAGNISPORA*.—6 AND 7 b. *T. REGULARIS*.—7 a. *T. MULTIPARTITA*.
 —8. *T. SCISSLIS*.—9. *T. CARYOPHYLLEA*.

EXPLANATION OF PLATE

PLATE 5.

Fig. 10. *T. terrestris*. From specimens collected on ground in open fields at Middle Grove, N. Y. *a* shows the fibrose-strigose upper surface and fimbriate margin of the pileus, and *b*, the hymenium of lower surface.

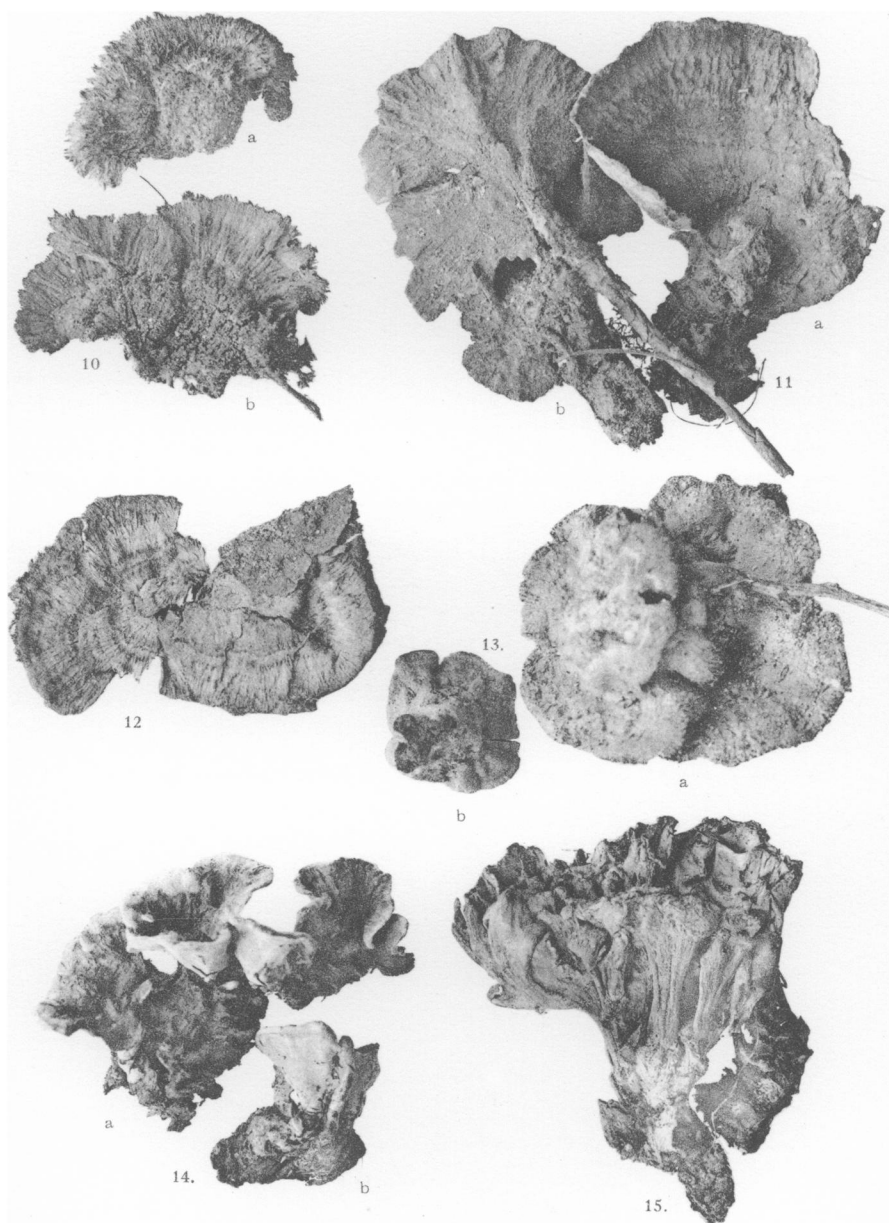
Fig. 11. *T. intybacea*. From specimens collected in pine woods incrusting fallen pine leaves and twigs at Middlebury, Vt. *a* shows upper surface with matted, adnate squamules and whitish, thick, entire margin; *b*, the hymenium of lower surface.

Fig. 12. *T. griseozonata*. From specimen of type collection, distributed in Ravenel, Fun. Amer., No. 444.

Fig. 13. *T. albedo-brunnea*. *a*, upper side of specimen collected at Saugatuck, Mich., by E. T. and S. A. Harper, No. 654. The specimen is about 2 cm. thick; *b*, hymenium of specimen collected at Lake Dunmore, Vt.

Fig. 14. *T. cuticularis*. From specimens collected at Blue Mounds, Wis., by E. T. and S. A. Harper, No. 861. *a*, viewed obliquely from above; *b*, viewed from under side to show hymenium.

Fig. 15. *T. vialis*. From specimen collected at Lake Dunmore, Vt.



BURT—THELEPHORACEAE OF NORTH AMERICA

10. THELEPHORA TERRESTRIS.--11. T. INTYBACEA.--12. T. GRISEO-ZONATA.--
13. T. ALBIDO-BRUNNEA.--14. T. CUTICULARIS.--15. T. VIALIS.